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Original communication

Palmar dermatoglyphics in children with acute lymphoblastic leukemia – A preliminary investigation

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ABSTRACT

Background: Acute lymphoblastic leukemia (ALL) is a malignant disease of as yet an unknown origin. Researchers in the past have studied the association between dermatoglyphic features in the hand and congenital diseases and diseases with genetic influences.
Objective: The present research is intended to study the association between acute lymphoblastic leukemia (ALL) and palmar dermatoglyphic characteristics to assess the value of dermatoglyphics as a screening tool to detect leukemia in high risk groups.
Methods: Case-control study conducted at the department of Pediatrics, KMC Attavara, a tertiary care teaching hospital of Kasturba Medical College, Mangalore (Manipal University), India during 2006. Twenty-four children suffering from acute lymphoblastic leukemia were included in the study. The dermatoglyhic features (ab– ridge count, atd, tda and dat angles) of their palm prints were compared with the age and sex matched controls.
Results: The present research indicates an association between dermatoglyphic features and ALL. The mean ab–ridge count, and the mean atd – angle were observed to be higher in cases while the mean tda – angle was found to be lower in cases than controls.
Conclusions: The findings of the present research are suggestive of a possible trend and an association of dermatoglyphic features with children suffering from ALL. Similar studies can be useful in rare forensic case work where the association of dermatoglyphic features with certain diseases is to be explored.

1. Introduction

Acute lymphoblastic leukemia (ALL) is a malignant disease of as yet an unknown origin in which there is an uncontrolled proliferation of white blood cell precursors leading to its various clinical manifestations. ALL is seen most often in the age group of 2–10 years with a peak at 3–4 years. The incidence decreases with increasing age, though there is a secondary peak after 40 years. In children it is the most common malignant disease and accounts for 70% of all childhood leukemias.[1] Cellular features of ALL in children suggest that the disease originates very early in embryogenesis. Palmar flexion creases also develop in the embryo at the same time as the blood-forming cells, and because both arise from mesodermal tissue, insults to the embryo that may lead to leukemic changes in the blood-forming cells may also result in aberrant palmar crease patterns.[2]

Dermatoglyphics is the study of the patterns of ridges on the skin of the fingers, palms, toes, and soles. Dermatoglyphics are of interest in the field of anthropology, criminology, and medicine, including dysmorphology and the study of chromosomal abnormalities such astrisomy 21. In the field of anthropology and criminology, studies have been conducted to explore the sex differences in fingerprint ridge density.[3–6] Kanchan and Chattopadhyay have studied the distribution of fingerprint patterns among medical students[7] while Nithin et al. studied thefingerprint classification and their gender distribution among South Indian population.[8] Ethnic variations in palmar dermatoglyphics have been reported in a recent research by Sen et al.[9] Specific changes in the

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dermatoglyphic patterns have prompted researchers to search for dermatoglyphic markers which can help in the early diagnosis of the diseases. A number of earlier studies have studied the association between congenital diseases, and diseases with genetic influences and the dermatoglyphic features in the hand.[10–12] A possible trend and an association of finger print patterns with children suffering from ALL have been explored.[13]

The present research is intended to study the association between ALL and palmar dermatoglyphic characteristics that to the best of our knowledge have not been studied earlier. The study compares the palmar dermatoglyphic characteristics in children diagnosed with ALL to those who are not suffering from it.

2. Materials and methods

2.1. Study setting

Hospital based study at the department of Pediatrics, KMC Attavara, a tertiary care teaching hospital of Kasturba Medical College, Mangalore (Manipal University), India during 2006. It is a multi-specialty hospital providing comprehensive health care to the patients of Dakshina Kannada district.

2.2. Study design

Case-control study.

2.3. Sample size

48 children (24 cases and 24 controls).

2.4. Materials

A Plain glass plate of size 15 × 15 cm, black duplicating ink (Kores), roller, magnifying lens, white bond paper, soap and dry towel were used in the study.

2.5. Cases

A group of twenty-four children (males = 11, females = 13) aged below 16 years who attended the pediatric oncology out patient department of KH, and with confirmed diagnosis of ALL based on bone marrow findings, cytochemistry, and immunophenotyping, were enrolled as 'cases' in the study after taking informed consent from the parents/guardians. Case history and investigations of the

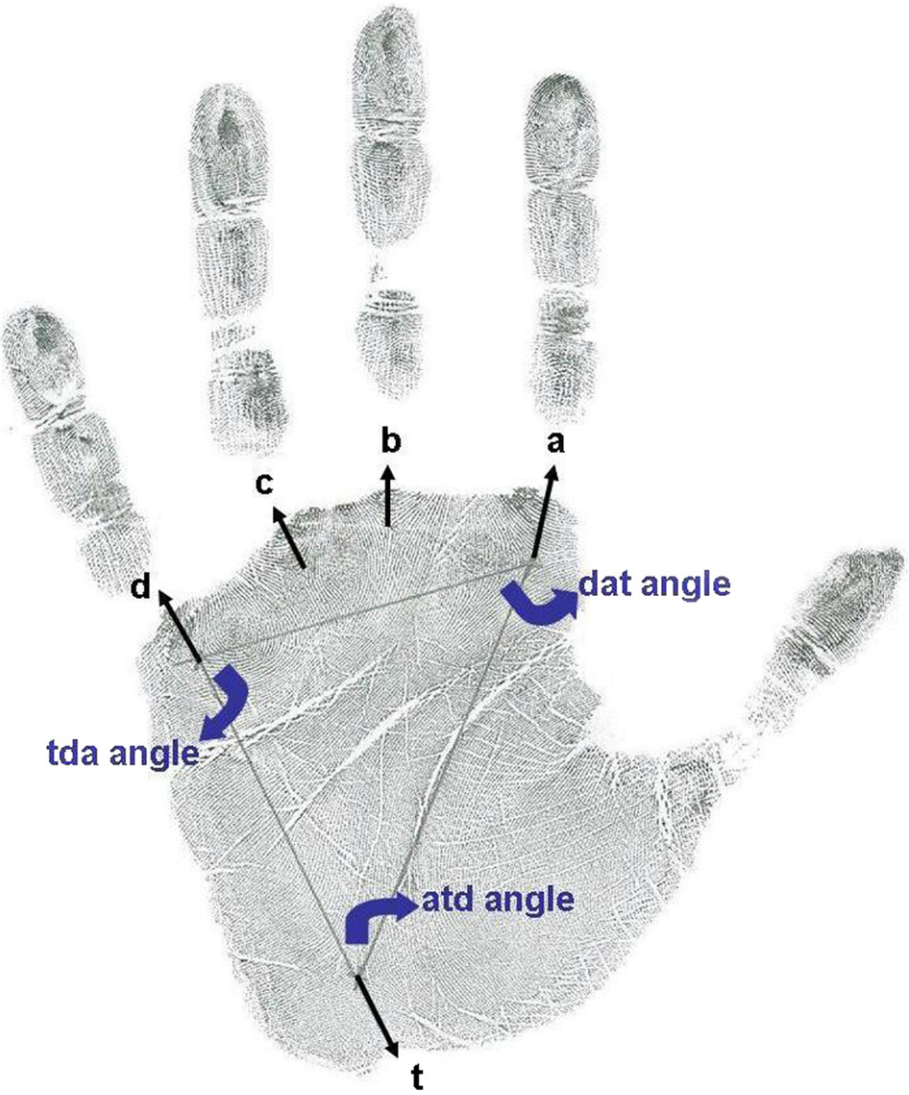

Fig. 1. A palm print illustrating the triradii points and the palmar angles.

patients were recorded in detail. Classification of leukemia into T-cell and B-cell disease was done based on the immunophenotype with T-cell ALL showing a preponderance of CD3, CD7 markers and B-cell ALL showing a preponderance of CD10, CD19 and CD20 markers. Unconfirmed cases of ALL, children suffering from any other malignancies including acute myeloid leukemia, children with other congenital malformations or diseases or suffering from local injury/deformation of hands were excluded from the study.

2.6. Controls

Twenty-four healthy children (males = 13, females = 11) aged below 16 years, and without evidence of any malignancies/congenital disease and/or injury/deformation of hands were enrolled as 'controls' after taking informed consent.

2.7. Methodology

Institutional ethical committee approval was taken prior to the study. Informed consent was obtained from each participant's guardian before undertaking the research. Each child was asked to wash hands clean with soap and water. A clean plain glass plate was uniformly smeared with black duplicating ink with the help of a roller. The children were asked to apply their hand on the smeared plate and then transfer them on to a white paper. Regular pressure was applied on the hand to obtain palm prints from both right and left sides.

The following dermatoglyphic variables were analyzed for both hands (Fig. 1):

1 a − b ridge count: Number of ridges between the triradius 'a' and triradius 'b' that were counted with the help of magnifying lens.
2 'atd', 'tda', and 'dat' angles: Angles between the straight lines joining triradii points 'a', 't', and 'd' were measured.

A triradius is a point where the ridges deviate into three directions. Triradius 'a', 'b', 'c', and 'd' are the triradius of the second, third, fourth, and fifth digits respectively. These are located just below the respective digits, between the metacarpo-phalageal crease of the digits and the bracelet creases. The axial triradius 't' is usually located in the proximal part of the palm in between the hypothenar and thenar eminences and is in alignment of the fourth metacarpal.[14]

Statistical considerations could not be effectively applied owing to the small sample size of this preliminary time bound research project.

3. Results

Mean age of the cases and controls was 8.2 and 8.7 years respectively. B-cell leukemia (n = 16) was reportedly twice as common as T-cell leukemia (n = 8). Most of the cases (50%) were aged between six and ten years. Age distribution of cases and types of ALL is shown in Table 1.

Table 1
Distribution of T-cell and B-cell leukemia cases in various age groups.

Age Groups	T-Cell Leukemia	B-Cell Leukemia	Total
1–5 years	02	04	06
6–10 years	05	07	12
11–16 years	01	05	06
Total	08	16	24

Table 2
ab − ridge count among cases and controls.

	Range Left hand	Mean (S.D)	Range Left hand	Mean (S.D)
Cases (n = 24)	26–49	39.4 (6.0)	32–50	39.5 (4.4)
Controls (n = 24)	25–48	38.6 (6.2)	26–49	38.5 (5.5)

S.D − Standard Deviation.

Mean ab − ridge count was higher in cases than controls. No differences were observed in the mean ab − ridge count between right and left hands in cases and controls (Table 2). Mean atd − angle was higher in cases while mean tda − angle was higher in controls. Difference between cases and controls for dat − angle was apparently marginal. Details of palmer angles and right-left differences are shown in Table 3.

4. Discussion

A significant increases in palmer single flexion creases ('simian line') and Sydney creases have been associated with mental retardation in Down's syndrome and missing interphalangeal flexion creases and "sandal" plantar creases on the soles of the feet in children with Downs and Rubinstein-Taybi syndromes.[15] Increased incidence of Sydney creases have been observed in children with delayed development, learning difficulties, minor behavioral problems and leukemias[16] congenital rubella and possibly cytomegalovirus syndromes.[17] Oorthuys et al. in their study 'Palmar flexion creases in childhood neoplasia'[18] reported that ALL had Sydney type of unusual creases and found that the variations commonly occurred in younger patients. Further, they reported that the parents of these children also showed significant increase in unusual creases in their hands. With regards to crease variance a similar variation was seen for ALL and embryonic malignant tumors. The study identified a significant association between the increased incidence of unusual palmar creases in children with ALL and their siblings as compared to controls. This led them to postulate that dermatoglyphic assessment of children in families with higher risk of malignancies may serve as an excellent screening tool to identify high risk cases that may subsequently develop malignancies.[18] This postulate however, awaits a further detailed prospective study over an extended duration for confirmation.

The association between dermatoglyphics and ALL in children was studied extensively by Edelstein et al.[2] They investigated the relationship between aberrant palmar creases in children who developed ALL in the age group 6 yrs and below. The dermatoglyphic patterns of the affected children were compared to age and sex matched controls. Significant differences in bilateral aberrant palmar creases between ALL children and the others were observed. Their study led to the suggestion that carcinogenic insult might occur during the first trimester of pregnancy which is the period of peak organogenesis. They also identified unusual palmer creases in the siblings of ALL patients and suggested that

Table 3
Palmar angles among cases and controls.

	Range Left hand	Mean (S.D)	Range Left hand	Mean (S.D)
atd − angle				
Cases (n = 24)	35–62	46.0 (5.9)	34–70	46.7 (7.1)
Controls (n = 24)	37 61	45.6 (7.3)	28–58	43.4 (6.2)
tda − angle				
Cases (n = 24)	69–100	79.3 (6.8)	50–88	77.8 (7.3)
Controls (n = 24)	75–95	80.7 (4.0)	73–95	80.9 (4.5)
dat − angle				
Cases (n = 24)	40–64	54.7 (5.5)	48–64	55.5 (4.7)
Controls (n = 24)	36–62	53.7 (7.3)	42–66	55.7 (5.7)

S.D − Standard Deviation.

a pre-leukemic change had occurred in-utero before the blood brain barrier had established.

The present research indicates an association between dermatoglyphic features (mean ab − ridge count, and mean atd − angle that were higher in cases and mean tda − angle that was lower in cases than controls) and ALL in children. None of the earlier studies on the subject have utilized the dermatoglyphic characteristics analyzed in the present study and hence, the findings of our study with regard to their association with ALL can not be compared perse.

5. Conclusion

The present research is suggestive of an association between ALL and palmar dermatoglyphic features. However, in absence of the statistical analysis due to a smaller sample size, and overlap in values, the findings of this preliminary study should be read with caution. Though a diagnosis of ALL can hardly ever be based on the dermatoglyphic features alone, they can possibly be a useful screening tool for early identification of childhood ALL, especially in high risk families. Further extended studies on larger cohorts will be required to confirm the findings and application of our study. Future studies using a computer aided dermatoglyphic assessment and studies involving the siblings of children with leukemia, to identify common dermatoglyphic characteristics may be useful. The study highlights on the possible utility of dermatoglyphics in the field of medicine and pathology. Similar studies can be useful in rare forensic case work where the association of dermatoglyphic features with certain diseases is to be explored.

6. Contributors credits

MJB conceived and designed the study, collected data and drafted the paper. He will act as guarantor of the study. ATKR conceived the study and helped in manuscript writing. TK analyzed and interpreted the data. TK revised the manuscript for important intellectual content. BU also designed the study, and helped in analysis of the results. MFB and VNK assisted in manuscript writing. The final manuscript was approved by all authors.

Conflict of interest statement

The authors have no conflict of interest to declare.

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Ethical approval

None declared.

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